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| **Lesson Title: How Can We Design a Tornado-Proof Building** |
| **Subject area / course / grade level: 5th grade Science and Language** |
| **Introduction:**  This month saw a spate of destructive tornadoes sweep the nation from the Midwest to North Carolina, destroying homes, businesses, and even a college campus. Some of the largest and most damaging twisters in history occurred in 1999 in Oklahoma and Kansas. Overall, these tornadoes caused 49 deaths and over $1 billion in damage. Tornadoes affect civil engineers the most because they design, build, and maintain roads, railways and buildings. Engineers also collect evidence following storms to help classify tornadoes, dispel tornado myths, and find better ways to safely build structures in high-tornado areas. We all are aware of the devastation which occurred in our neighboring state of Alabama. Almost 400 deaths, people striving to survive without power, and homes destroyed devastated parts of Alabama on April 27, 2011.  Buildings are not always built to resist a tornado, it is important to understand tornado safety procedures. The first thing to do if you know there is a tornado coming is go and find shelter, immediately! Safe places include storm cellars, basements, or interior rooms that have no windows. If you are in a mobile home, leave it! Tornadoes like to pick these up or flatten them! If you can, place a mattress, sleeping bag, or heavy blanket over your body to protect yourself.  Now that you know everything – well not quite everything! – it is time to make a better house for a family that lives in Tornado Alley, the country’s mid-section where most tornadoes occur. (Norman, Okla., in the heart of Tornado Alley, experiences a [distinct tornado season](http://www.nssl.noaa.gov/primer/tornado/tor_hazardgraph.html) from February to May.) Tornadoes can produce winds over 250 mph. According to the National Oceanographic and Atmospheric Administration (NOAA), about [1,300 tornadoes](http://www.srh.noaa.gov/jetstream/tstorms/tornado.htm) are reported across the United States in an average year, resulting in 80 deaths and over 1,500 injuries. Nearly half of these deaths were people living in mobile homes.  With these statistics in mind, it is easy to see why it is important for engineers to build buildings that can withstand the tremendous forces of a tornado. Can you come up with a few ideas to design a house that will be super tornado proof? |
| **Lesson Length: 3- 50 minute class periods (1 day in the Library for research)** |
| **Materials:**  1.1 sheet of white poster board  2. Variety of crayons, markers, pencils  3. Books and information on tornadoes  4. Invite a structural or civil engineer to discuss building designs that help prevent loss during windstorms and  tornadoes. |
| **Lesson Overview:**  Student teams use their knowledge of tornadoes and damage to design a structure that will withstand wind and protect people from twisters. Each group will create a poster with the name of their engineering firm and a picture of their structure. Finally, each group will present their posters to the class. |
| **Tennessee Standards:**  **Language Arts:**  1. Demonstrate confidence and poise in various speaking situations  2. Demonstrate critical listening skills essential for comprehension and evaluation  3. Engage in problem solving through group discussions  4. Present and support ideas/opinions in group discussions  5. Demonstrate appropriate language structure, tone and voice control in oral communication  **Science:** |
| **Lesson objective(s):**  1. Understand that tornadoes affect humans by causing property damage and loss of life.  2. Describe the damage to structures caused by tornadoes.  3. Understand how and why engineers design new and better buildings to withstand tornadoes.  4. Understand the Fujita Tornado Damage Scale ([interactive game](http://profhorn.aos.wisc.edu/wxwise/tornado/t.html) at www.profhorn.aos.wis.edu) of tornado intensity  rates.  5. Understand some basics of tornado safety.  6. Read and write for a variety of purposes and audiences. |
| **ENGAGEMENT:**  As a class, have the students engage in open discussion. Remind students that in brainstorming, no idea or suggestion is “silly.” All ideas should be respectfully heard. Encourage wild ideas and discourage criticism of ideas. Have them raise their hands to respond. Write answers on the board. Ask the students: **How might a tornado damage a house?**  Watch a video of [one designer’s futuristic plans](http://www.youtube.com/watch?v=SZ5ySOoGi2w) for an underground tornado-proof home on youtube.com (I had to pre-record this on a disk) or the [Discovery Science series](http://science.discovery.com/videos/build-it-bigger-hurricane-proof-homes-3.html) on building hurricane-proof homes. |
| **EXPLORATION:**  TSW make 3D models of their tornado-proof homes.  Students can add safety measures for an entire community to their posters. Some suggestions include: building standards that all houses have a storm cellar or basement, community storm shelters for mobile home parks or public places, warning sirens, weather radios, community safety workshops, or banning mobile homes in Tornado Alley. |
| **EXPLANATION**  1. Discuss how tornadoes can damage buildings; i.e., cause them to crumble, blow roofs off, or become damaged by flying debris. Lead a short brainstorming session with students asking them to think of ways a tornado might damage a house. 2. Tell students that they will be designing their own tornado-proof structure. Some ideas for students to use in their structures are: improve roof shingles and the roof design, devise better ways to secure the house walls, anchor the foundation, and use of better building materials. Students can think of any other creative ideas that they want. How about adding sails on a house and using it as a tornado boat! The objective is to be creative; there are no wrong answers. 3. Students should get into design teams of two to four. 4. They will use what they have learned about tornadoes in previous activities to design a poster of a house that will stand up to high wind speeds. This activity uses a lot of creativity, and there are no “wrong” designs. They can use ideas such as including a basement for protection during a tornado and coming up with better building designs. 5. Have student groups name their engineering firm (e.g., Wind-Proof Structural Engineers). The poster should have labels that briefly describe what is labeled and how it protects from tornadoes. Students can use the Tornado Safety Handout to get some ideas of things to add to a house. 6. Using the interactive Fujita Tornado Damage Scale the University of Wisconsin’s “Weather wise” site, have students rate what tornado their structure can withstand and include this rating on the poster. A 7. The second class period is for presenting their building to their peers. Student presentations should include a general overview of their building, as well as a description of each labeled feature on their poster. |
| **ELABORATION**  Have students brainstorm ideas to design a new school that will stand up to a tornado’s high-speed winds. First, assign one student in the group to be the recorder. Then have someone toss out an idea. Next, another person in the group provides an idea that builds on the first. Go around the group in this fashion until all students have put in enough ideas to put together a design. When they are done, have them share their ideas with the class. |
| **EVALUATION:**  Completed poster board and explanations. |